Worksheet 5 Bitwise manipulation and masks
Answers

Task 1

1. Figure 1 shows a byte containing a signed integer. The value of the carry bit is unknown.

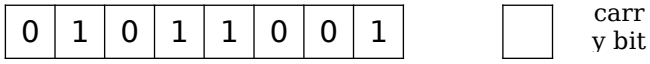

Figure 1

Show the result of performing the following shifts, starting each time with the byte given in Figure 1.

(a) a logical right shift: 0 0 1 0 1 1 0 0 — 1

(b) a logical left shift: 1 0 1 1 0 0 1 0 — 0

(b) an arithmetic left shift: 0 0 1 1 0 0 1 0 — 1

(c) an arithmetic right shift: 0 0 1 0 1 1 0 0 — 1

2. Using a combination of shifts and addition, multiply 13 by 6

13	0000 1101	
13 x 2	0001 1010	(a)
13 x 4	0011 0100	(b)
Add a, b	0100 1110	check 78 = 13 x 6

3. Figure 2 shows an 8-bit byte containing an integer.

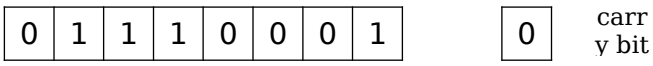

Figure 2

Show the result of performing the following **consecutive** shifts on the byte.

(a) a circular right shift: 0 0 1 1 1 0 0 0 — 1

(b) a circular right shift: 1 0 0 1 1 1 0 0 — 0

(c) an arithmetic left shift: 1 0 1 1 1 0 0 0 — 0

(d) an arithmetic right

1	1	0	1	1	1	0	0

0

shift:

Task 2

4. A system has 8 switches which are controlled by a binary code.Switches 1, 4 and 8 are currently ON.

   (a) It is desired to set switch 7 to a '1' without altering the other switches. Show how this can be done with a mask and a logical operator.

Switch number	1	2	3	4	5	6	7	8
Current state	1	0	0	1	0	0	0	1
OR with	0	0	0	0	0	0	1	0
Result	1	0	0	1	0	0	1	1

   (b) It is now desired to set bits 1 to 4 to 0 without altering bits 5 to 8. Show how this can be done with a mask and a logical operator.

Switch number	1	2	3	4	5	6	7	8
Current state	1	0	0	1	0	0	0	1
AND with	0	0	0	0	1	1	1	1
Result	0	0	0	0	0	0	0	1

5. The ASCII codes for the numbers 0 to 9 are from 0011 0000 to 0011 1001. Using the ASCII code for "1" as an example, show how these can be translated into pure binary using an XOR mask and a logical operator.

	1	2	3	4	5	6	7	8
code for 1	0	0	1	1	0	0	0	1
XOR with	0	0	1	1	0	0	0	0
Result	0	0	0	0	0	0	0	1

   Show an alternative solution using a different mask.

	1	2	3	4	5	6	7	8	
code for 1	0	0	1	1	0	0	0	1	
AND with	1	1	0	0	1	1	1	1	(or 0 0 0 0 1 1 1 1)
Result	0	0	0	0	0	0	0	1	